but not with action of pancreatic extract on starch. Peptic and pancreatic digestions of albuminoids were almost prevented by this agent.

It is obvious from these experiments that the indiscriminate use of these agents in the preservation of food is to be regarded as objectionable and a proper subject of sanitary supervision. Their use is scarcely allowable under any circumstances, and certainly only when the nature of the preservative, and the amount, are distinctly stated. These remarks apply more particularly to salicylic acid, saccharine, and beta-naphthol; but the use of boric acid and sodium acid sulphite may be brought also under the same restrictions, because their actions on the animal functions are not yet thoroughly investigated.

CONTAGIOUSNESS OF LEPROSY. — The contagiousness of leprosy still continues to be a mooted question. Dr. Rake, superintendent of the Trinidad Leper Hospital, has made a report to the British Medical Association which embodies the results of his experiments in the cultivation of the germ of leprosy, the *bacillus lepræ*, which have been under way for the past four years. He says that (1) at a tropical temperature and on the ordinary nutrient media he has failed to grow the *bacillus lepræ;* (2) in all animals yet examined he has failed to find any local growth or general dissemination of the bacillus after inoculation, whether beneath the skin, in the abdominal cavity, or in the anterior chamber; feeding with leprous tissues has also given negative results; (3) he has found no growth of the *bacillus lepræ* when placed in putrid fluids or buried in the earth. He further says that an inquiry of this kind is practically endless, so varied are the conditions of temperature, time, nutrient media, living animal tissues, or putrescent substance, and so many are the observations necessary to avoid or lessen the risk of errors of experiment.

FATAL SEASICKNESS. — It is not often that seasickness proves fatal; and yet that it may do so under aggravated circumstances, can easily be imagined. Such an instance recently occurred on the steamer 'Dunara Castle,' on the trip from Tiree to the Clyde. The patient was a girl, aged eight years, in whom the seasickness terminated in a convulsion, which proved fatal.

MILK. — Dr. S. Henry Dessau, in a letter to the *New York Medical Record*, recommends the use of fresh condensed milk as a substitute for mother's milk. His objections to the use of cow's milk as supplied by the milk-dealers are, that during the summer months it is impossible to obtain it fresh and unadulterated in large cities, unless at a cost beyond the reach of the masses. All of the milk that is delivered in the market of New York is at least from twelve to twenty-four hours old, and has undergone rough transportation of from fifteen to thirty miles in not strictly clean vessels. The cans used in bringing the milk to the city are not cleansed until returned to their owner. By the time that the milk has reached the poorer classes, it has commonly undergone more or less adulteration, often in spite of the closest watching by the health authorities. In the course of its consumption by the average infant, it is still further liable to lactic-acid fermentation, and, even though boiled, it is not unlikely to become scorched or made otherwise unwholesome for the infant. Perhaps the most important objection to cow's milk, notwithstanding the fact that it is regarded as the nearest approach to mother's milk, is the difficult digestion of the caseine by the delicate infant whose stomach has been damaged by an attack of summer diarrhœa. This has necessitated the invention of numerous means and measures for overcoming the obstacle, the most common of which is the addition of some farinaceous substance. Such practice for an infant, previous to the eruption of its teeth, is contrary to the provisions of nature, and, though occasionally successful, cannot be defended as a general usage upon physiological principles. Dr. Dessau thinks it impossible to adulterate condensed milk, and that the caseine of condensed milk is so altered in the condensing process as to be very easily digested. He even prefers it to milk sterilized by Soxhlet's method.

DEATH BY DROWNING. — Dr. Paul Loye, according to the *Lancet*, has published some observations made by him, bearing on the phenomena which precede death by sudden immersion. The first stage of deep inspirations lasts about ten seconds, followed by a re-action caused by the resistance to the entrance of water into the bronchioles. This lasts for a minute, and is succeeded by arrest of respiration and loss of consciousness. Finally the scene closes with four or five respiratory efforts — the last. Immersion causes an immediate rise in the blood-pressure, with slowing of the heart-beats. The action of the heart remains slow but strong till death ensues. The pressure gradually lessens, but rises just before death, to fall to zero immediately afterward. The heart sometimes continues to beat feebly for about twenty minutes. The result is the same in animals which have been tracheotomized: the period of respiratory resistance is therefore due to the respiratory muscles, and not to spasm of the glottis.

INHERITED DEFICIENCY OF A TOOTH. — Dr. Cryer says, in the *Philadelphia Medical Times*, that he has, among his patients, members of the same family, representing five generations, each lacking the left lower lateral incisor tooth. An interesting feature of this remarkable instance of heredity is that one of the members of the same family has a supernumerary lower incisor.

WHOOPING-COUGH. — The value of Mobin's treatment of whooping-cough by sulphurous acid is receiving strong confirmation from many sources. Dr. Manly, in the *Practitioner*, expresses the opinion, that, if it was carried out in every case, at the end of six months the disease would be unknown. The method used by him is as follows: the patient is in the morning put into clean clothes and removed elsewhere. All his clothes and toys, etc., are brought into the bedroom, and sulphur is burnt upon a few live-coals in the middle of the room. The fire is allowed to remain in the room for five hours, and then the windows and doors are thrown open. The child sleeps in the room the same evening. About twenty-five grams (a little under an ounce) of sulphur to every cubic metre may be burnt: this is equivalent to rather more than ten grains per cubic foot. The room is fumigated in a like manner during the night; the patient practically living in an atmosphere of diluted sulphurous-acid gas for some days, while in several cases the process is repeated at the end of a week.

THE POWER OF THE IMAGINATION. — We learn from the *New Orleans Picayune* that Dr. Durand, wishing to test the practical effect of mind-disease, gave a hundred patients a dose of sweetened water. Fifteen minutes after, entering apparently in great excitement, he announced that he had by mistake given a powerful emetic, and preparations must be made accordingly. Eighty out of the hundred patients became thorougly ill, and exhibited the usual result of an emetic: twenty were unaffected. The curious part of it is, that, with very few exceptions, the eighty 'emeticized' subjects were men, while the strong-minded few, who were not to be caught with chaff, were women.

MENTAL SCIENCE.

The Recognition of Sense-Impressions.

WE inherit from so ancient a philosopher as Aristotle the recognition of the process of the association of ideas, as well as of the laws by which it acts. He distinguished association by similarity, by contrast, by simultaneity, and by successiveness. The contrast that binds together is due to an underlying similarity, and the latter term may stand for both processes. So, again, the last pair may be included under association by adjacency. In the hope of deciding which of these two general processes is the more real and generic, or whether, perhaps, the two apply to two different spheres of perceptions, Dr. Alfred Lehmann (*Philosophische Studien*, v. 1) devised a series of experiments, which, aside from their bearing upon this theoretical problem, present many points of interest.

The association of ideas is seen at work in the process of recalling, of recognizing as familiar, former impressions. We may speak of a simple recognition in which the mere identity of the present recollection with the mental impression formerly registered is the point; or of a recognition with details in which the time, place, outward circumstances, are also recalled with the remembrance of the impression, say, that of meeting a friend. To this must be added the recognition by means of these details, they serving as

the marks by which the impression is identified. Dr. Lehmann attempted to bring the problem to a simple issue by a study of the power of recognizing various shades of gray produced by the rotation of a disk partly white and partly black. Two such rotating disks were used, either of which could be disclosed without the other. First a 'normal' disk was shown; after an interval, either a darker or a lighter disk was shown; and the subject was to decide whether the second disk was or was not the same as the first. With this judgment, the direction of the difference, whether lighter or darker, is always noticed. In the first series, the normal disk was composed of equal parts of black and white; the lighter disk (only two disks were used) varied in the number of degrees of white it contained as in the table; the interval between the appearance of the two disks was thirty seconds, and the average number of correct answers in a set of thirty judgments for each of two observers was as follows: —

Degrees of white in disk	240	225	215	200	192	188
Observer B	29	30	27	29	17	18
Observer L	27	27	24	20	19	17

We see at once that the power of recognizing the identity of the disks decreases as the difference in shading between the normal and the light disk diminishes; fifteen answers of each thirty being right by the action of chance. The difference between the normal disk (180 degrees) and the disk of 188 degrees white is hardly recognized at all.

If we next complicate the matter by introducing a darker disk that shall always contain as much more black than the normal as the lighter contains more white, the power of recognizing the normal disk when it appears, though still the same act, is made more difficult, as the following table, based on a series of experiments precisely similar to those just cited, indicates: —

Degrees of white in dark disk	120	135	145	160	168	172
Degrees of white in light disk	240	225	215	200	192	188
Observer B	30	30	23	23	18	10
Observer L	23	23	22	20	14	11

Here mere guess-work would make ten answers in thirty correct. The proportion of correct answers is smaller than in the former case, markedly so when the disks approach one another in shade. An increase in the number of possible impressions out of which we are to select a particular one increases the difficulty of the act.

Again: the interval between the viewing of the two disks acts in a similar way. When but two disks were used, always differing by 12 degrees in the amount of white they contained (and the normal disk varying from 172 to 176 degrees of white), the average number of right answers per set of thirty, with the interval varying from five to a hundred and twenty seconds, was as follows: —

Interval in seconds	5	15	30	60	120
Observer B	30	26	25	19	17
Observer L	21	20	21	19	17

In explanation of the individual differences, we recall that it has been clearly shown that our memories are not equally retentive for all kinds of impressions, but that here personal inclination and talent find free play. Observer B is a student of art, with an interest for such color-distinctions, and thus naturally surpasses his companion. On the other hand, the effect of practice, tested by comparing the first half of the experiments with the last, is equally evident in both observers. It is to be noted, too, that after about thirty seconds the memory-images have been about equally obscured in both observers, B then making as many errors as L.

Dr. Lehmann holds, that, if we recognize color-shades by similarity, we should (when three disks are employed) less often fail to recognize the normal than the other disks, because we see it oftener than either of the others, it being shown every time. On the other hand, the adjacency hypothesis would not expect such a difference if the original shade was clearly held in memory. If the remembrance is indistinct, the extremes, the lighter and darker disks, would be less apt to be wrongly identified than the normal disk. The results speak in favor of the latter view. B, with a clear memory, made 107 confusions, in 55 of which he miscalled the normal disk, and in 52 of which he confused either the lighter or darker disk with the normal one or with one another. L, with a vague memory, made 165 confusions, 109 of which belong to the former class, and 56 to the latter.

For another experiment three scales, proceeding from black to white by five, by six, and by nine equal gradations, were prepared; and after viewing this scale, any one of the five, of the six, of the nine shades of gray was separately shown, and the attempt made to assign to it its place in the scale. With the scale of five grades (five observers and sixty observations), 96.7 per cent of all identifications were correct; with the scale of six shades (three observers, thirty-four observations), 70.6 per cent; with the scale of nine shades (four observers, fifty observations), 46 per cent. Dr. Lehmann believes that the five shades are so well identified because they have names attached to them, — black, white, dark gray, light gray, and medium gray, — and supports this by the fact that he succeeded in identifying the shades of nine-shade scale 75 per cent of all times by simply associating a number with each shade. This argues for the association through details or by adjacency in opposition to association by similarity.

If this adjacent mark is really the clew to recognition, then it ought to be a great help to have the two disks (in the first-mentioned experiments) shown side by side before shown separately for recognition. Furthermore, if the difference between the two disks is great enough to be clearly perceived, it ought to be no more likely to be overlooked than when it is much more marked. A comparison of the following with the first table supports both these inferences: —

Degrees of white in light disk	240	225	215	200	192	188
Observer B	28	29	21	23	19	25
Observer C	27	28	24	22	20	22

Furthermore, so slight an interval as from five to a hundred and twenty seconds ought not seriously to affect the clearness of this distinction. A comparison of the following with the third table bears evidence to the truth of this deduction (the normal disk contains 180, the lighter 215, degrees of white): —

Interval in seconds	15	30	60	90	120
Observer K	26	23	27	27	25
Observer L	23	27	23	28	25

To more completely show that this retention was not due to the persistence of a memory after-image, an interval of a hundred and twenty seconds was used, within which another recognition-experiment was made. It was found that this interruption did not seriously decrease the number of correct recognitions.

Individual differences ought likewise not to be so marked with this process, and a reference to the tables shows that they are slight. Practice has little effect. Four observers made correct identifications 'through details' 83.8, 85.8, 85.8 and 85.4 per cent of all cases, while two observers differed in the percentage of correct 'simple identifications' by as much as 83.5 and 67.6 per cent.

Dr. Lehmann thus concludes that the associative law that best explains the facts is the law of adjacency in opposition to the law of similarity.

THE MAGNET AND HYPNOTISM. — The claim that the magnet influences hypnotic phenomena is strongly upheld by Parisian experimenters, while others as boldly deny this influence. The effects attributed to the magnet can be explained as due to unconscious suggestion from the operators and the bystanders. Dr. Tanzi

agrees in this opinion, which is also the verdict of a commission appointed by the medical congress held at Paris. The results announced by the Paris doctors were not obtained, and often were replaced by directly opposite results. The experiments of all outside of Paris seem to be opposed to the alleged influence of the magnet on hypnotic sensations.

THE DREAMS OF THE DEAF. — In the course of an article on dreams, etc., Mr. J. M. Buckley (*Century*, July, 1888) mentions that he has at various times made inquiry as to the occurrence of sounds in the dreams of the deaf, and found no such instance when deafness set in before the fourth year of life. One correspondent mentions that deaf people dream of hearing, if they became deaf after learning to speak. The deaf are very sensitive to jars, waking up by the beating of a bass-drum, and this class of sensations is represented in their dream-life. These facts illustrate in a conclusive manner the dependence of the imaginative and constructive powers upon the sensations, as well as point to the existence of an era when this dependence is no longer necessary for the retention of dream-fancy.

ELECTRICAL SCIENCE.

Production of Light in the Future.

THE following very interesting extract from Prof. Oliver Lodge's 'Modern Views of Electricity,' that has appeared in *Nature*, is given in the *London Electrician*: —

"The conclusions at which we have arrived, that light is an electrical disturbance, and that light-waves are excited by electric oscillations, must ultimately and very shortly have a practical import.

"Our present systems of making light artificially are wasteful and ineffective. We want a certain range of oscillation, between seven thousand and four thousand billion vibrations per second (no other is useful to us, because no other has any effect on our retina); but we do not know how to produce vibrations of this rate. We can produce a definite vibration of one or two hundred or thousand per second: in other words, we can excite a pure tone of definite pitch, and we can command any desired range of such tones continuously by means of bellows and a key-board. We can also (though the fact is less well known) excite momentarily definite ethereal vibrations of some millions per second, but we do not at present seem to know how to maintain this rate quite continuously. To get much faster rates of vibration than this, we have to fall back upon atoms. We know how to make atoms vibrate: it is done by what we call 'heating' the substance; and if we could deal with individual atoms, unhampered by others, it is possible that we might get a pure and simple mode of vibration from them. It is possible, but unlikely; for atoms, even when isolated, have a multitude of modes of vibration special to themselves, of which only a few are of practical use to us, and we do not know how to excite some without also the others. However, we do not at present deal with individual atoms: we treat them crowded together in a compact mass, so that their modes of vibration are really infinite.

"We take a lump of matter, say a carbon filament or a piece of quicklime, and by raising its temperature we impress upon its atoms higher and higher modes of vibration, not transmuting the lower into the higher, but superimposing the higher upon the lower, until at length we get such rates of vibration as our retina is constructed for, and we are satisfied. We want a small range of rapid vibrations, and we know no better than to make the whole series leading up to them. It is as though, in order to sound some little shrill octave of pipes in an organ, we were obliged to depress every key and every pedal, and to blow a young hurricane.

"I have purposely selected as examples the more perfect methods of obtaining artificial light, wherein the waste radiation is only useless, and not noxious. But the old-fashioned plan was cruder even than this: it consisted simply in setting something burning, whereby not only the fuel, but the air, was consumed; whereby also a most powerful radiation was produced, in the waste waves of which we were content to sit stewing, for the sake of the minute, almost infinitesimal fraction of it which enabled us to see.

"Every one knows now, however, that combustion is not a pleasant or healthy mode of obtaining light; but everybody does not realize that neither is incandescence a satisfactory and unwasteful method, which is likely to be practised for more than a few decades, or perhaps a century.

"Look at the furnaces and boilers of a great steam-engine driving a group of dynamos, and estimate the energy expended; and then look at the incandescent filaments of the lamps excited by them, and estimate how much of their radiated energy is of real service to the eye. It will be as the energy of a pitch pipe to an entire orchestra.

"It is not too much to say that a boy turning a handle could, if his energy were properly directed, produce as much real light as is produced by all this mass of mechanism and consumption of material.

"There might, perhaps, be something contrary to the laws of nature in thus hoping to get and utilize some specific kind of radiation without the rest; but Lord Rayleigh has shown, in a short communication to the British Association at York, that it is not so, and therefore we have a right to try to do it.

"We do not yet know how it is true, but it is one of the things we have got to learn.

"Any one looking at a common glow-worm must be struck with the fact that not by ordinary combustion, nor yet on the steam-engine and dynamo principle, is that easy light produced. Very little waste radiation is there from phosphorescent things in general. Light of the kind able to affect the retina is distinctly emitted; and for this, for even a large supply of this, a modicum of energy suffices.

"Solar radiation consists of waves of all sizes, it is true; but then solar radiation has innumerable things to do besides making things visible. The whole of the energy is useful. In artificial lighting nothing but light is desired: when heat is wanted, it is best obtained separately by combustion. And so soon as we clearly recognize that light is an electrical vibration, so soon shall we begin to beat about for some mode of exciting and maintaining an electrical vibration of any required degree of rapidity. When this has been accomplished, the problem of artificial lighting will have been solved."

ENERGY ABSORBED BY DIFFERENT LIGHTS. — Mr. Preece, in his address before the British Association, gave some figures on the energy required to produce a light of one-candle power from different illuminants.

One candle light				maintained by	tallow absorbs	124 Watts
"	"	"	"	"	wax absorbs	94 "
"	"	"	"	"	sperm absorbs	86 "
"	"	"	"	"	mineral oil absorbs	80 "
"	"	"	"	"	vegetable oil absorbs	57 "
"	"	"	"	"	coal-gas absorbs	68 "
"	"	"	"	"	cannel-gas absorbs	48 "
"	"	"	"	"	electricity (glow) absorbs	3 "
"	"	"	"	"	electricity (arc) absorbs	5 "

The relative amounts of heat given off may be estimated from these figures, tallow candle giving off 248 times as much heat as an arc-lamp for the same amount of illumination. As for the cost of production (Mr. Preece evidently does not include distribution), the following figures hold good in London. The cost of producing one candle light for one thousand hours is: —

	s.	*d.*
Sperm candles	8	6
Gas	1	3
Oil (petroleum)	0	8
Electricity (glow)	0	9
Electricity (arc)	0	1½

THE SHALLENBERGER ELECTRIC METER. — Among the numerous meters for electric currents that have been lately invented, that of Mr. Shallenberger is deserving of attention, from its ingenuity and apparent accuracy. It consists of a flat ring of soft iron mounted on an aluminium disk fixed on a spindle and surrounded by two coils, one of which is connected, either directly or through a small converter, with a circuit whose current is to be measured; the other of which is of an oval form closely surrounding the iron ring, and is short-circuited on itself. The meter is intended to measure alternating currents, and its action is briefly as follows. The alternating current in the first coil induces currents in both the